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The *Hibbertia polystachya–H. spicata* (Dilleniaceae) species group in Western Australia

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Abstract

Thiele, K.R. The *Hibbertia polystachya–H. spicata* (Dilleniaceae) species group in Western Australia. *Nuytsia* 30: 291–308 (2019). *Hibbertia spicata* F.Muell. and *H. polystachya* Benth. are widespread in south-western Western Australia, where they are unique in *Hibbertia* Andrews in having flowers in a cincinnus rather than solitary. The boundary between these two species has been problematic, as they mostly differ in the composition and density of indumentum on their sepals and leaves. Close study has revealed that *H. polystachya* is widespread and taxonomically relatively straightforward, while *H. spicata sens. lat.* comprises six distinctive, readily resolvable species (including *H. leptotheca* (J.R.Wheeler) K.R.Thiele *comb. et stat. nov.*, previously *H. spicata* subsp. *leptotheca* J.R.Wheeler) differing in leaf and sepal indumentum, number of flowers in the cincinnus, floral bract shapes, stamen number, and number and arrangement of staminodes. New species described here are *H. capensis* K.R.Thiele *sp. nov.*, *H. asterella* K.R.Thiele *sp. nov.* and *H. subglabra* K.R.Thiele *sp. nov*. The new name *H. prolata* K.R.Thiele is provided for a widespread taxon based on *Hemistephus linearis* J.Drumm. ex Harv. With these species removed, *H. spicata* is recircumscribed and is now more restricted in distribution.

Introduction

Hibbertia spicata F.Muell. was described by Mueller (1860) based on a specimen collected by Walcott and A.F. Oldfield, probably in 1859, at Port Gregory (between Geraldton and Kalbarri). In the protologue, Mueller noted its close affinity with *Hemistephus linearis* J.Drumm. ex Harv., described by Harvey (1855) based on a Drummond specimen from 'Northern Districts'. Bentham (1863) synonymised the latter name under the former (the combination in *Hibbertia* Andrews being unavailable due to the epithet being preoccupied by *H. linearis* R.Br. ex DC.).

Bentham (1863) also described *Hibbertia polystachya* Benth. based on two specimens, a Drummond collection from 'Swan River' and an Oldfield collection from the 'Blackwood River'. He included both species in his sect. *Hemipleurandra* Benth., noting that unlike other species in the section, *H. spicata* and *H. polystachya* have flowers borne in a '1-sided spike' rather than singly. He gave as the key difference glabrous leaves in *H. spicata* compared with hirsute leaves (and sepals) in *H. polystachya*, noting also that the former has staminodes completing the ring of stamens while the latter has no or few staminodes (sometimes with only a single one behind the stamens).

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Wheeler (1984, 1987, 2004) commented on the close relationship between these two species and the difficulty of separating them at times. Wheeler (2004) gave the key difference as the sepals, bracts and young leaves being glabrous or with minute stellate and hooked hairs in *H. spicata c.f.* having fairly long, coarse, simple hairs (sometimes also with underlying minute stellate hairs) in *H. polystachya*. She considered (Wheeler 1984) that the difference in staminodes provided by Bentham (1863) was unreliable, with some specimens from each species having identical staminode arrangements. She further noted that (1) some specimens appear intermediate between the two species, speculating that closer study might reveal that *H. polystachya* and *H. spicata* are conspecific, and conversely that (2) *H. spicata* is morphologically variable within its range, with the implication that it may contain further taxa.

Wheeler (1984) added a third taxon to the group when she described *H. spicata* subsp. *leptotheca* J.R.Wheeler for specimens occurring along the coastal plain from Lancelin, north of Perth, southwards to Yalgorup National Park. These differ from typical subsp. *spicata* in having longer, more slender anthers, fewer (or no) staminodes, and outer sepals that are glabrous or almost so. She noted that subsp. *leptotheca* is geographically and ecologically separated in the Perth region from subsp. *spicata*, the former occurring on coastal limestones and the latter being absent from the coastal plain in that region (although elsewhere occurring on coastal limestones e.g. at North West Cape).

Hibbertia polystachya and *H. spicata* are striking amongst *Hibbertia* species in south-west Western Australia in having flowers borne in cincinni (often described as 'one-sided spikes'; Figure 1), all other species in the area having sessile or pedicellate flowers borne singly and terminating shoots (sometimes appearing axillary to leaves when terminating axillary short-shoots or following overgrowth of an axillary shoot arising below the flower). Two other groups of *Hibbertia* also have cincinnate inflorescences: a northern Australian species group including *H. muelleri* Benth. and *H. candicans* (Hook.f.) Benth., and a New Caledonian radiation including *H. pancheri* (Brongn. & Gris) Briq. and *H. vieillardii* (Brongn. & Gris) Gilg. Despite striking similarities in their inflorescences, the molecular phylogeny of Horn (2005) resolves these as separate clades, with *H. spicata* in a clade with other (single-flowered) species from south-western Australia such as *H. acerosa* (R.Br. ex DC.) Benth. (*H. polystachya* was not included in the phylogeny).

Horn (2005) analysed inflorescence structure and floral development in *H. polystachya* and concluded that the cincinnus is a highly sylleptic sympodium; that is, each flower terminates its axis, with subsequent flowers 'higher up' in the inflorescence derived from axes produced from the axil of the subtending bract of the terminal flower and with the bract carried sylleptically up the axis so that it appears to subtend the next-distal flower. Usually only one flower is open in each cincinnus at any given time.

This study assessed morphological variation in *H. polystachya* and *H. spicata* to determine whether the two taxa should be retained as separate or whether the variation noted by Wheeler (1984) indicates that further taxa should be recognised. Significant variation was found, in the indumentum of young stems, leaves and sepals, in the number of flowers and shape and arrangement of bracts in the cincinnus, in flower size, in the number of stamens, and in the number, shape and arrangement of staminodes. The morphological variation is geographically and ecologically correlated and consistent with the recognition of four new species and the raising of *H. spicata* subsp. *leptotheca* to species rank. The group thus comprises seven distinct and readily recognisable species.

Figure 1. Flowering branches of two species in the *Hibbertia spicata-H. polystachya* group. A – *H. prolata* (Zig Zag Road, Gooseberry Hill, 28 Sep. 2019); B – *H. asterella* (*K.R. Thiele* 5590, 2 Oct. 2019). Photos by K.Thiele.

Methods

All specimens at PERTH were examined. Types of *Hibbertia spicata*, *H. polystachya* and *Hemistephus linearis* were viewed at MEL; other type specimens were viewed on JSTOR *Global Plants* (https://plants.jstor.org/). Leaf and sepal measurements are based on dried specimens; petal, stamen and style measurements are based on herbarium material rehydrated in hot water with a little detergent. Maps are based on all specimens held at PERTH and are drawn using IBRA v. 7 (Department of the Environment 2013) bioregion and subregion boundaries.

Key to species in the *Hibbertia spicata–H. polystachya* species group

1. Outer sepals moderately to densely stellate-hairy, with no or few simple hairs

2. Whole plant (young stems, leaves and sepals) densely stellate-pubescent; stamens 10–12; most staminodes opposite the stamens ..... **1. H. asterella**

2: Young stems and leaves ±glabrous; stamens 12–16; most staminodes behind the stamens ..... **2. H. capensis**

1: Outer sepals glabrous to pilose, mostly with simple or hooked hairs (stellate hairs, when present, a minor component of the indumentum)

2. Abaxial leaf lamina and midrib glabrous..... **3. H. subglabra**

2: Abaxial leaf lamina where exposed (and where hidden by the recurved margins) densely stellate-pubescent, the midrib often glabrous

3. Flowers (6–)8–14 per cincinnus, overlapping; cincinnus bracts distinctly heteromorphic, each flower (except the lowermost) subtended by a ±linear and a broadly ovate to triangular bract ..... **4. H. spicata**

3: Flowers (1)2–6(7) per cincinnus, the lowermost at least well-separated; cincinnus bracts not distinctly heteromorphic, each flower (except the lowermost) subtended by two ±linear to ovate bracts differing mainly in length

4. Adaxial leaf laminas and outer sepals quite glabrous ..... **5. H. leptotheca**

4: Adaxial leaf laminas and/or outer sepals hairy

5. Adaxial leaf laminas ±glabrous; sepals mostly with hooked hairs ..... **6. H. prolata**

5: Adaxial leaf laminas pubescent to pilose with simple hairs; sepals with a mix of simple, stellate and hooked hairs ..... **7. H. polystachya**

Taxonomy

1. Hibbertia asterella K.R.Thiele, *sp. nov.*

Type: Bokal Road North, 1.4 km from Boyup Brook-Arthur River Road, Western Australia, 2 October 2019, *K.R. Thiele* 5590 (*holo*: PERTH 09085122; *iso*: AD, CANB, MEL)

Prostrate, compact or spreading *shrubs* to 0.3(–0.7) m high, multi-stemmed at base and resprouting from the rootstock after fire; young stems moderately to densely stellate-pubescent; older stems with smooth to scabrid, papery, dull or silvery bark decorticating in flakes and strips. *Leaves* spreading-erect, scattered, linear, (10–)12–25 mm long, 1–2 mm wide; margins revolute but the abaxial lamina usually exposed; adaxial lamina coarsely stellate-pubescent with tubercle-based hairs (rarely with scattered simple hairs amongst the stellate ones); abaxial lamina finely and densely stellate-pubescent, the midrib with indumentum as for the adaxial surface; apex obtuse and recurved-apiculate. *Inflorescences* comprising 2–4-flowered cincinni, the lowermost flowers usually well-separated; cincinna axis with indumentum as for the stems; bracts ±homomorphic, narrowly ovate to linear, the lowermost 3–6 mm long, 0.8–2 mm wide, often leaf-like in having recurved margins, a prominent midrib, and indumentum as for the leaves. *Sepals* ovate, 5–6 mm long, abaxially densely tuberculate-stellate; midribs prominent; outer sepals acute; inner sepals similar to the outer but smaller. *Petals* yellow, broadly obovate, 7–10 mm long, shallowly to deeply emarginate. *Stamens* 10–12, all on one side of the gynoecium, shortly fused by their filaments; anthers oblong, 1.5–2 mm long, dehiscing by introrse, longitudinal slits. *Staminodes* 10–16, a few lateral to but most opposite the stamens. *Carpels* 2; ovaries rather rectangular-cuboid, densely pubescent; styles excentric from near the carpel apex, ±straight then slightly curved at the apex, 1–1.5 mm long. *Ovules* 2 per carpel. *Fruiting carpels* and seeds not seen. (Figure 1A)

Diagnostic features. May be distinguished from all other species in the *Hibbertia spicata* species group by the densely and coarsely stellate-pubescent leaves, cincinnus bracts and sepals.

Other specimens examined (all PERTH). WESTERN AUSTRALIA: Wingebellup Rd, E of Unicup Rd and N of Kulanilup Reserve, 15 Nov. 2017, *G. Byrne* 6738; Dardadine Rd South between Bunce King Rd and O'Connor Rd, ESE of Dardadine, 8 Nov. 1993, *V. Crowley* DKN392A; NE of Dinninup, 28 Oct. 1998, *R. Davis* 8228; *c.* 23 km NW from Darkan Rock, 25 Aug. 1997, *A. Gundry* 583; Yarnup Nature Reserve, 25 Oct. 1997, *G.J. Keighery & N. Gibson* 2631; Kululinup [Kulunilup] Nature Reserve, 26 Oct. 1997, *G.J. Keighery & N. Gibson* 2746; Albion Rd, *c.* 32 km SW of Kojonup, 29 Oct. 1997,

C.M. Lewis 311; Graham Rd, SW Narrogin, 8 Oct. 1998, *G. Warren* 43; North Kulikup, Darkan, 14 Sep. 2005, *A. Webb* BNC970; Between Albany Hwy and Boddington, *c.* 2 km from Albany Hwy, 26 Sep. 1983, *J.R. Wheeler* 2202; Just W of Cuballing, *c.* 1.5 km along Cuballing West Rd, 10 Oct. 2001, *J.R. Wheeler* 4135.

Phenology. Flowers in September and October, most records being from the latter month.

Distribution and habitat. Scattered in south-west Western Australia from the vicinity of Boddington to Yarnup Nature Reserve west of Frankland River (Figure 2), growing in grey to red-brown loamy, clay and sandy soils over granite and laterite, in open marri, jarrah and wandoo woodlands.

Conservation status. Widespread and scattered, including in several nature reserves, and not considered to be at risk.

Etymology. From the Latin *aster* (a star) with the diminutive *-ella*, in reference to the leaves and sepals that are densely stellate-pubescent.

Notes. *Hibbertia asterella* is distinctively grey-hoary due to the abundant tubercle-based stellate

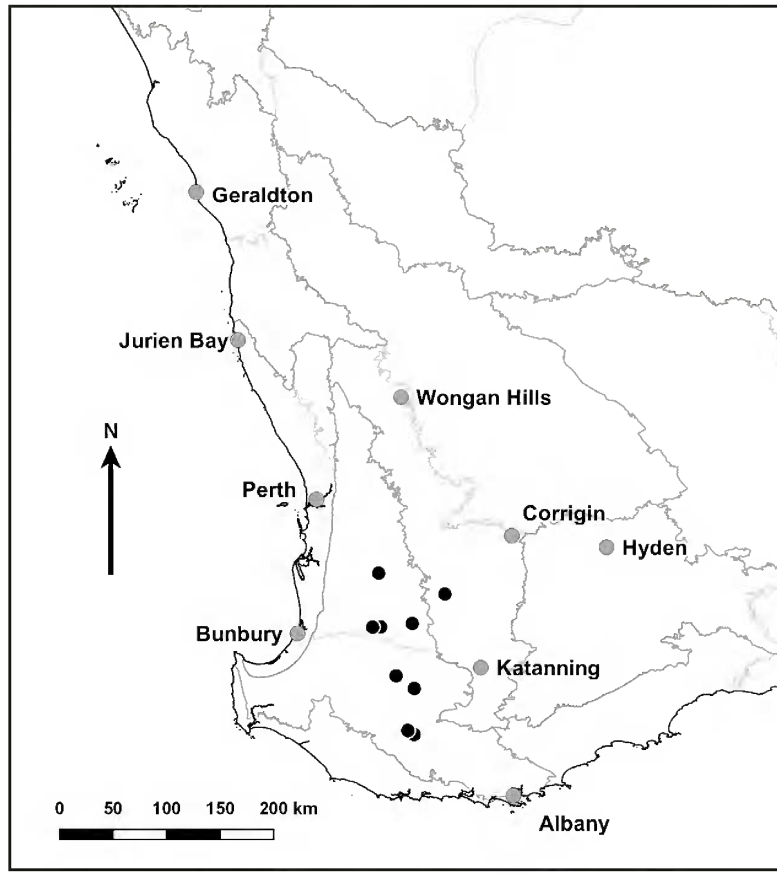

Figure 2. Distribution of *Hibbertia asterella*.

hairs on all parts. While minute stellate hairs are variably found in some other taxa in this group (e.g. *H. prolata*, *H. polystachya*) they are a minor component of the indumentum (except in *H. capensis* which has minutely stellate-hairy sepals). Most specimens of *H. asterella* lack simple hairs amongst the stellate ones.

2. Hibbertia capensis K.R.Thiele, *sp. nov.*

Type: Track north of Charles Knife Road; summit of Cape Range, Cape Range National Park, Western Australia, 17 June 2019, *G.J. Keighery & K. Lilburn s.n* (*holo*: PERTH 09085165!; *iso*: AD, CANB).

Much-branched, erect, compact *shrubs* to 0.8 m high, multi-stemmed at base and resprouting from the rootstock after fire; young stems sparsely stellate-pubescent with minute hairs; older stems with dull, grey, fissured bark. *Leaves* spreading to erect, scattered, linear, 15–35 mm long, *c.* 1 mm wide; margins tightly revolute to the midrib and hiding the abaxial lamina; adaxial lamina glabrous except for fine hairs at the very base, scattered-tuberculate; abaxial lamina obscured by the recurved margins but when visible densely stellate-pubescent; midrib glabrous; apex acute. *Inflorescences* comprising 2–4(–6)-flowered cincinni, the lowermost flowers well-separated to overlapping; cincinna axis minutely and finely stellate-pubescent; bracts ±heteromorphic with one broader and one narrower and with a ±constricted base, the broader one ovate to broadly ovate or triangular, the lowermost 3–4 mm long, 1–2.5 mm wide, finely stellate-pubescent. *Sepals* very broadly ovate to almost orbicular, 6.5–8 mm long, abaxially very finely and minutely stellate-pubescent; midribs prominent; outer sepals obtuse to subacute; inner sepals similar to the outer but smaller and more obtuse. *Petals* yellow, broadly obovate, 10–13 mm long, shallowly to deeply emarginate. *Stamens* 12–16, all on one side of the gynoecium, shortly fused by their filaments; anthers oblong, 1.8–2 mm long, dehiscing by introrse, longitudinal slits. *Staminodes* 10–12, all behind and lateral to the stamens, filiform. *Carpels* 2; ovaries rather rectangular-cuboid, densely pubescent; styles excentric from near the carpel apex, ±straight then slightly curved at the apex, 1.8–2 mm long. *Ovules* 2 per carpel. *Fruiting carpels* and seeds not seen.

Diagnostic features. May be distinguished from all other species in the *Hibbertia spicata* species group by the combination of very finely and minutely stellate-pubescent sepals and leaves that are glabrous above and densely stellate-pubescent on the lamina below.

Selected specimens (all PERTH). WESTERN AUSTRALIA: Eastern end of Yardie Creek, Cape Range National Park, 2 July 2006, *J. English* 58; Cape Range – Charles Knife Rd, 30 Aug. 1960, *A.S. George* 1328; NW Cape - Lighthouse Hill, 31 Aug. 1960, *A.S. George* 1365; Cape Range Peninsula, small creek 5 km S of Exmouth, 2 Oct. 1995, *S. Hunger & N. Kilian* 4195; *c.* 4 miles [6 km] E of Ningaloo Station Homestead, 4 Sep. 1970, *A.S. George* 10222; Pilgonaman Creek, 67 km from Exmouth, on Yardie Creek Rd, Cape Range National Park, 26 July 1980, *K.F. Kenneally* 7308; Minilya–Exmouth Rd near Gales Bay, 6 July 2008, *K.R. Thiele* 3558.

Phenology. Flowers from May to November, with a peak in July.

Distribution and habitat. Restricted to Cape Range between North West Cape and Ningaloo Station (Figure 3), on red loams and sands over limestone, often in watercourses, in *Acacia* shrublands, low open mallee and *Triodia* grasslands.

Conservation status. Common in its restricted area of distribution and not considered to be at risk in

the short term, although its occurrence in an arid environment indicates that it is likely to be adversely affected by climate change.

Etymology. From the Latin 'of the Cape' in reference to the disjunct distribution on North West Cape.

Notes. *Hibbertia capensis* is the only *Hibbertia* species found in the semi-arid Cape Range and is widely disjunct from all other species. It shares a limestone habitat with *H. leptotheca* and *H. spicata*; the former differs in having glabrous outer sepals and longer, narrower anthers, while the latter has more flowers in the cincinnus and long, simple hairs on the cincinnus bracts and sepals. Leaves of *H. capensis* have very strongly recurved margins tightly abutting the midrib and entirely obscuring the abaxial leaf lamina. It is often necessary to break leaves to see the stellate lamina pubescence.

A specimen from Charles Gardner Flora Reserve near Tammin (*R.D. Royce* 8377) closely matches *H. capensis* in leaves and in its sepal indumentum, and does not match *H. polystachya*, which occurs in the area, or the other widespread species *H. prolata*. Unless matching material from the locality is found and assigned to a taxon, it is most likely that the sheet is mis-labelled.

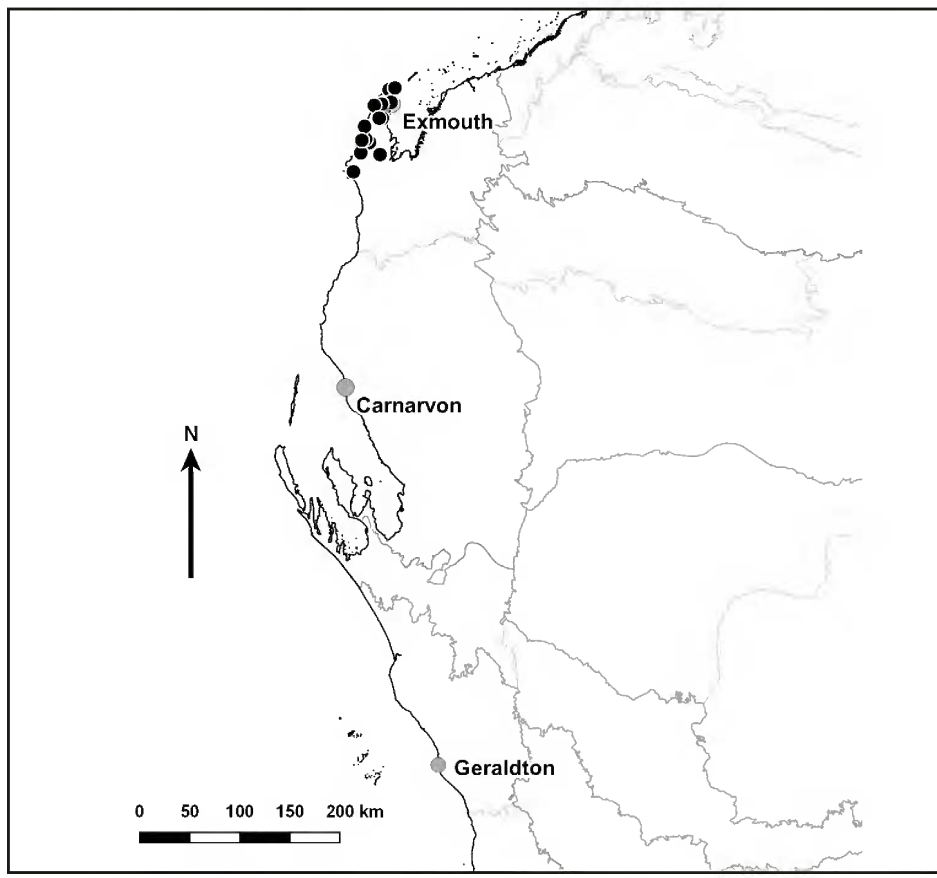

Figure 3. Distribution of *Hibbertia capensis*.

3. Hibbertia subglabra K.R.Thiele, *sp. nov.*

Type: Coorow–Green Head Road, Western Australia [Precise locality withheld for conservation reasons], 7 September 2019, *K.R. Thiele* 5565 (*holo*: PERTH 09085130; *iso*: AD, CANB).

Erect, dwarf *shrubs* to 0.3(–0.5) m high, multi-stemmed at base and resprouting from the rootstock after fire; young stems glabrous except for prominent hair-tufts in the axils; older stems with smooth, papery, silvery bark decorticating in flakes and strips. *Leaves* erect to spreading, scattered, linear, 12–30(–40) mm long, (0.6–)1–2(–3) mm wide; margins loosely revolute, the abaxial lamina usually exposed; adaxial lamina glabrous except at the very base above the axil, smooth to finely scattered-tuberculate; abaxial lamina and midrib glabrous; apex acute, straight to slightly upturned. *Inflorescences* comprising 2–6-flowered cincinni, the lowermost flowers usually well-separated; cincinna axis glabrous or sparsely simple-hairy; bracts ±homomorphic, ovate to triangular, the lowermost 2–3.5 mm long, 0.8–1 mm wide, sparsely hairy as for the sepals. *Sepals* broadly ovate, 3–6 mm long, abaxially with sparse, long, sub-appressed to spreading hairs that are simple or sub-stellate and straight or hooked at the apex; midribs not prominent; outer sepals obtuse; inner sepals similar to the outer but smaller, broader and with fewer hairs, minutely stellate-hairy where covered by the outer. *Petals* yellow, broadly obovate, 8–10 mm long, shallowly to deeply emarginate. *Stamens* 9 or 10, all on one side of the gynoecium, shortly fused by their filaments; anthers oblong, 1.5–1.8 mm long, dehiscing by introrse, longitudinal slits. *Staminodes* 5–7, linear-flattened, behind and lateral to the stamens. *Carpels* 2; ovaries rather rectangular-cuboid, densely pubescent; styles excentric from near the carpel apex, ±straight then slightly curved at the apex, 1.4–1.8 mm long. *Ovules* 2 per carpel. *Fruiting carpels* and seeds not seen.

Diagnostic features. May be distinguished from all other species in the *Hibbertia spicata* species group by the glabrous abaxial leaf lamina.

Other specimens examined (all PERTH). WESTERN AUSTRALIA: [localities withheld for conservation reasons] 19 Sep. 1983, *R.J. Cranfield* 4266; 15 Oct. 1946, *C.A. Gardner* 8430; 5 Sep. 1976, *E.A. Griffin* 1006; 18 Sep. 1979, *E.A. Griffin* 2274; 10 Sept. 1999, *J.W. Horn* 2366; 3 Oct. 1972, *B.R. Maslin* 3040; 4 Sep. 1984, *J.R. Wheeler* 2343.

Distribution and habitat. Restricted to a relatively small area between Cockleshell Gully and Eneabba (Figure 4). A disjunct occurrence near Mogumber (*R.J. Cranfield* 4266) may be an erroneous location; searches at the locality have failed to reveal any plants of *H. subglabra*. Occurs in sand over laterite on slopes and in gullies, in kwongan heath with scattered eucalypts.

Conservation status. Range-restricted and known from only seven specimens, some of which occur in conservation reserves. To be listed as Priority Three under Conservation Codes for Western Australian Flora (Smith & Jones 2018).

Etymology. From the Latin *glaber* (hairless) with the prefix *sub-* (under, beneath), in reference to the leaves that are abaxially glabrous.

Notes. *Hibbertia subglabra* is distinctive in its glabrous abaxial leaf lamina, all other species in the group being densely stellate-pubescent (except on the midrib). Specimens of all species often have the leaf margins strongly recurved and abutting the midrib, thus obscuring the abaxial lamina; in these cases, care must be taken to find leaves with less strongly recurved margins or that were folded on pressing to expose the abaxial lamina. Occasionally it is necessary to break a leaf to expose the lamina.

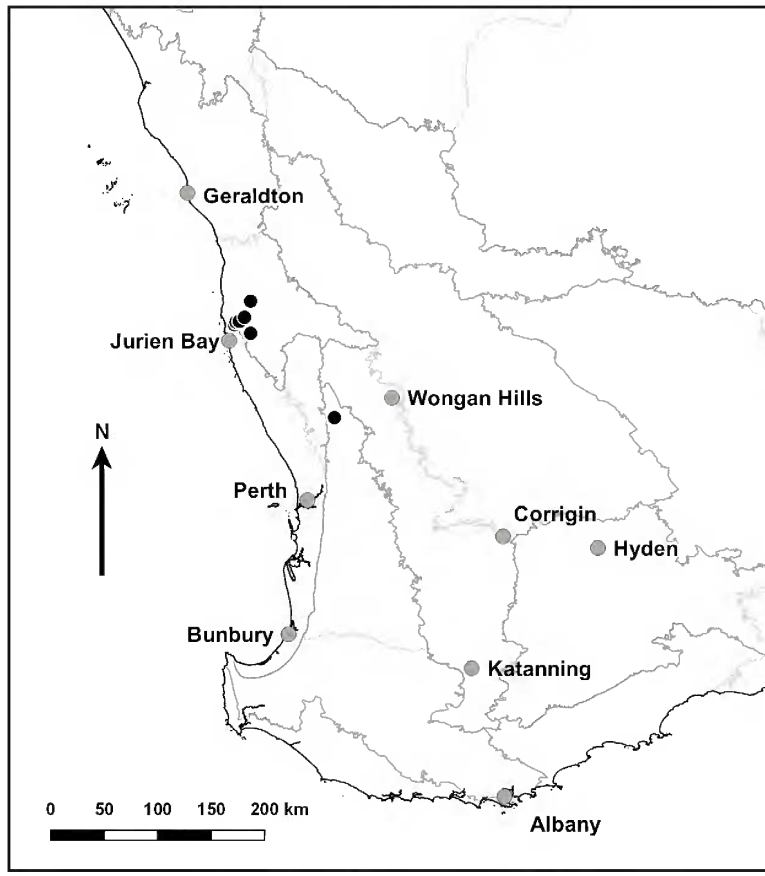

Figure 4. Distribution of *Hibbertia subglabra*.

This species often has unusually long, slender leaves compared with e.g. *H. prolata*.

One specimen of *H. prolata* (*J. Liddelow* 228) also has a glabrous abaxial lamina; however, in all other respects it is typical of its species and cannot be confused with specimens of *H. subglabra*.

4. Hibbertia spicata F.Muell, *Fragm. (Mueller)* 2(11): 1 (1860). *Type citation*: 'Ad portum Gregorii [Port Gregory]. Walcott et Oldfield.' (*syn*: K 687450 image!; MEL 666907 (fragments)!).

Erect to spreading, compact to open, sometimes dwarfed *shrubs* to 0.7 m high, multi-stemmed at base and resprouting from the rootstock after fire; young stems minutely and sparsely stellate-pubescent at first, soon glabrous; older stems with grey, fissured, papery bark. *Leaves* erect to spreading, scattered, linear, 12–25(–35) mm long, 1.2–2(–4) mm wide; margins revolute, the abaxial lamina hidden or exposed; adaxial lamina glabrous, scattered-tuberculate; abaxial lamina densely stellate-pubescent, the midrib glabrous; apex obtuse to sub-acute. *Inflorescences* comprising (6–)8–14-flowered cincinni, all flowers close and overlapping; cincinna axis sparsely stellate-pubescent; bracts heteromorphic, each flower (except the lowermost) subtended by a narrowly obovate-spathulate bract 3–4.5 mm long, 0.8–2 mm wide and a broadly ovate bract 3.5–7 mm long, 2.5–3 mm wide, the bracts sparsely hispid with hairs often restricted to the margins. *Sepals* ovate, 5–7 mm long, abaxially sparsely pubescent to

hispid with stellate or simple hairs especially along the midline; midribs not to moderately prominent; outer sepals obtuse; inner sepals similar to the outer but broader and with fewer or no simple hairs. *Petals* yellow, broadly obovate, 7.5–8 mm long, shallowly to deeply emarginate. *Stamens* 6(7), all on one side of the gynoecium, shortly fused by their filaments; anthers oblong, 1.5–1.7 mm long, dehiscing by introrse, longitudinal slits. *Staminodes* 10–14, short and broadly flattened, all around the gynoecium. *Carpels* 2; ovaries rather rectangular-cuboid, densely pubescent; styles excentric from near the carpel apex, ±straight then slightly curved at the apex, 2–2.5 mm long. *Ovules* 2 per carpel. *Fruiting carpels* and seeds not seen.

Diagnostic features. May be distinguished from all other species in the *Hibbertia spicata* species group by the cincinnus comprising 6–14 flowers, each flower (except the lowermost) subtended by two distinctly heteromorphic bracts, one broad and one narrow.

Selected specimens (all PERTH). WESTERN AUSTRALIA: Greenough Rd near Greenough River, 18 Aug. 2008, *L. Atkins* Sp 317; Spalding Park, 3 miles [5 km] N of Geraldton, 30 Aug. 1965, *A.C. Burns* 17; Horrocks Rd, 500 m from beach, 7 July 1997, *R. Davis* 3587; 20 km S of Kalbarri National Park boundary on Grey Rd, 7 Sep. 1997, *S. Donaldson & G. Flowers* SD1496; 2 miles [3 km] S of Red Bluff, 4 Sep. 1963, *A.R. Fairall* 1226; 60.4 km W along State Barrier Fence Access track from NW Coastal Hwy, 26 Aug. 1994, *G.J. Keighery & N. Gibson* 1349; Horrocks, 27 Aug. 1983, *C.M. Lynch* 154; Pot Alley Gorge, Kalbarri National Park, 26 Sep. 1974, *G. Perry* 301; Shark Bay, 29 Sep. 1989, *M.E. Trudgen* 7400; Chapman River Regional Park, Geraldton, 2 June 1999, *S. Vigilante* 61; Red Bluff, Kalbarri, 6 Sep. 1984, *J.R. Wheeler* 2375.

Phenology. Flowers from April to October, with a peak in early September.

Distribution and habitat. Occurs on coastal limestones from Geraldton to the southern end of Shark Bay (Figure 5). A few specimens have been recorded from coastal sandstone bluffs (e.g. Red Bluff) close to limestone. Grows in sandy and clay soils, in coastal heathlands, shrublands and low woodlands.

Conservation status. Relatively widely distributed including in several national parks and nature reserves, and not considered to be at risk.

Notes. Specimens of *H. spicata* are immediately recognisable by the many-flowered cincinni with the flowers and bract overlapping, giving a distinctively crowded appearance. In all other species the flowers are fewer and more widely-spaced (*H. capensis* sometimes also has overlapping flowers in the cincinnus). The cincinnus bracts in *H. spicata* are also distinctively heteromorphic. One bract is obliquely inserted on the cincinnus axis and is large and broad, while the other is transversely inserted and is much narrower.

5. Hibbertia leptotheca (J.R.Wheeler) K.R.Thiele, *comb. et stat. nov.*

Hibbertia spicata Benth. subsp. *leptotheca* J.R.Wheeler, *Nuytsia* 5(1): 35–37 (1984). *Type*: Yalgorup National Park, between the north end of Lake Preston and Martin's Tank Lake, Western Australia, 17 September 1981, *N.G. Marchant* 81/76 (*holo*: PERTH 1627198!; *iso*: CANB 363019 *n.v.*, MEL 677577!).

Small, spreading *shrubs* to 0.3 m high; young stems glabrous, multi-stemmed at base and resprouting from the rootstock after fire; older stems with grey, papery-fissured bark. *Leaves* spreading, scattered,

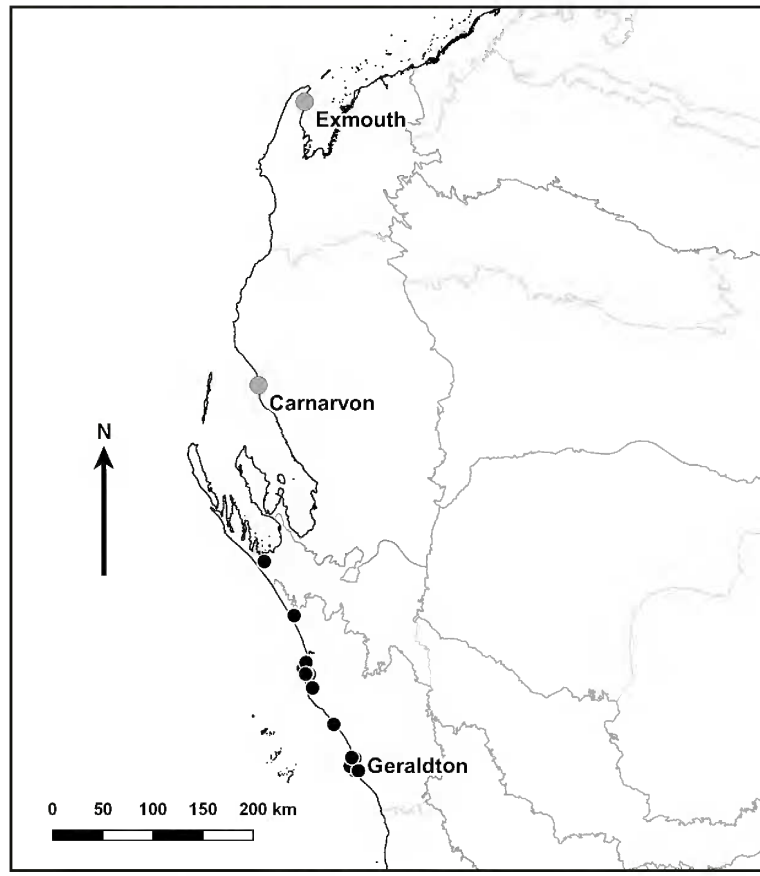

Figure 5. Distribution of *Hibbertia spicata*.

linear, (8–)12–25(–35) mm long, 0.8–1 mm wide; margins revolute and hiding the abaxial lamina or nearly so; adaxial lamina glabrous, smooth to rarely sparsely scattered-tuberculate; abaxial lamina where visible densely stellate-pubescent, the midrib glabrous; apex acute. *Inflorescences* comprising 2–5-flowered cincinni, the flowers well-separated; cincinna axis glabrous; bracts ±homomorphic, linear to narrowly obovate, 2–4 mm long, 0.8-1.5 mm wide, glabrous. *Sepals* ovate, 3.5–5 mm long, the outermost abaxially glabrous; midribs not prominent; outer sepals broadly acute; inner sepals similar to the outer but broader, more obtuse, glabrous or finely and sparsely minutely stellate-pubescent. *Petals* yellow, broadly obovate, 5–6 mm long, shallowly to deeply emarginate. *Stamens* (8–)10–12(–15), all on one side of the gynoecium, shortly fused by their filaments; anthers linear, 1.8–2.8 mm long, dehiscing by introrse, longitudinal slits. *Staminodes* 0(–3), when present lateral to or behind the stamens. *Carpels* 2; ovaries rather rectangular-cuboid, densely pubescent; styles excentric from near the carpel apex, ±straight then slightly curved at the apex, 2–2.5 mm long. *Ovules* 2 per carpel. *Fruiting carpels* and seeds not seen.

Diagnostic features. May be distinguished from all other species in the *Hibbertia spicata* species group by the glabrous outer sepals and long, narrow anthers.

Selected specimens (all PERTH). WESTERN AUSTRALIA: [localities withheld for conservation reasons] 20 Sep. 2003, *P. Foreman* 391; 8 Dec. 1992, *E.A. Griffin* 8401; 1 Sep. 1897, *R. Helms s.n.*

(PERTH 2625482); 21 Sep. 1990, *G.J. Keighery* 11492; 14 Sep. 1995, *G.J. Keighery* 14093; 25 Oct. 1982, *J.R. Wheeler* 2040; 27 Aug. 1957, *C.L. Wilson* 870.

Phenology. Flowers between August and October, with a peak in September.

Distribution and habitat. Occurs in coastal and near-coastal sites from west of Cataby south to Lake Preston (Figure 6), growing in sand over limestone in coastal heaths and thickets usually dominated by species of *Melaleuca* and *Acacia*.

Conservation status. Listed as Priority Three under Conservation Codes for Western Australian Flora (Smith & Jones 2018), under the name *H. spicata* subsp. *leptotheca*.

Notes. Wheeler (1984) described *H. leptotheca* as a subspecies of *H. spicata s.l.* She presumably used subspecies rank due to the wide variation she perceived in the latter, and because elsewhere in its range *H. spicata s.l.* shares a limestone habitat with *H. leptotheca* (i.e. the species segregated here as *H. capensis* and *H. spicata s.s.*). However, it is clearly separate both geographically and morphologically from other taxa in the group, with no intermediates, and constitutes a separately evolving lineage. I regard that species rank is appropriate for this taxon.

6. Hibbertia prolata K.R.Thiele, *nom. nov.*

Hemistephus linearis J.Drumm. ex Harv., in Hooker, W.J. (ed.), *Hooker's Journal of Botany and Kew Garden Miscellany* 7: 52 (1855); *Hemistemma lineare* (J.Drumm. ex Harv.) F.Muell., *Fragm. (Mueller)* 1(7): 162 (1859). *Type citation*: 'Northern Districts.' (*syn*: TCD 9690 image!, MEL 666664!).

Dense to open, often rounded, erect to spreading *shrubs* to 0.8 m high, multi-stemmed at base and resprouting from the rootstock after fire; young stems glabrous to sparsely stellate-pubescent with minute hairs, soon glabrous; older stems with grey, papery, fissured bark. *Leaves* erect to spreading, scattered, linear to very narrowly obovate, (10–)12–25(–30) mm long, 0.8–2 mm wide; margins revolute and usually hiding the abaxial lamina or nearly so; adaxial lamina glabrous, scattered-tuberculate; abaxial lamina densely stellate-pubescent, the midrib glabrous; apex acute, sometimes bluntly so. *Inflorescences* comprising (1–)2–5(–7)-flowered cincinni, the flowers well-separated; cincinna axis glabrous to sparsely stellate-pubescent; bracts ±homomorphic, linear to narrowly obovate, 2–3.5(–5) mm long, 0.5–1.5 mm wide. *Sepals* ovate, 5–6 mm long, abaxially with few to many, spreading to retrorse, hooked hairs mostly towards the base, sometimes underlain by sparse stellate hairs; midribs prominent; outer sepals acute; inner sepals broader and thinner-textured than the outer, with sparser hooked hairs. *Petals* yellow, broadly obovate, 6–8.5 mm long, shallowly to deeply emarginate. *Stamens* 10(–12), all on one side of the gynoecium, shortly fused by their filaments; anthers oblong, 1.2–1.8 mm long, dehiscing by introrse, longitudinal slits. *Staminodes* present, 6–20, behind, lateral to and/or opposite the stamens. *Carpels* 2; ovaries rather rectangular-cuboid, densely pubescent; styles excentric from near the carpel apex, ±straight then slightly curved at the apex, *c.* 1.5 mm long. *Ovules* 2 per carpel. *Fruiting carpels* and seeds not seen. (Figure 1B)

Diagnostic features. May be distinguished from all other species in the *Hibbertia spicata* species group by the leaf lamina that is adaxially glabrous and abaxially densely stellate-pubescent, and the outer sepals with few to many hooked hairs.

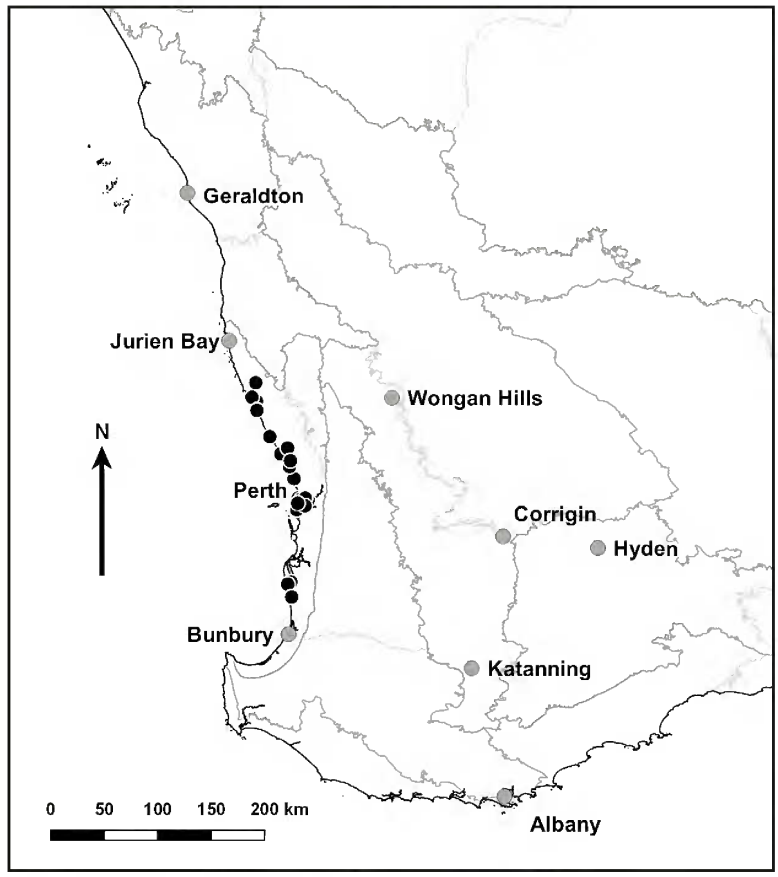

Figure 6. Distribution of *Hibbertia leptotheca*.

Selected specimens (all PERTH). WESTERN AUSTRALIA: Dingo Hill, 5 km along First North Rd from Eneabba-Three Springs Rd, 11 Oct. 2003, *J. Borger* BB212; junction of Cape Naturaliste Rd and Bunker Bay Rd, Dunsborough, 13 Oct. 2008, *H. Cole* 744; 3 km E of Woodanilling, 3 Nov. 1978, *R.J. Cranfield s.n.*; behind Gillingarra School, 6 Oct. 2006, *C. Danese & D. Rayner* BK 1006-06; Greenough River, 1 km W of the first railway crossing on Geraldton-Mullewa Rd, 55 km W of Mullewa, 20 Oct. 1983, *S.J. Forbes* 1714; Wagin, 26 Oct. 1920, *C.A. Gardner* 1003; Avondale Research Station, 6 km W of Beverley, 22 Oct. 1979, *R.J. Hnatiuk* 790181; near The Casuarinas (*c.* 36 miles [58 km] E of Geraldton), 18 Sep. 1971, *R.D. Hoogland* 11982; along North West Coastal Hwy S of Ajana-Kalbarri turn-off, near mile peg 369, 20 Sep. 1971, *R.D. Hoogland* 11996; S side of Eneabba-Three Springs Rd, 6.4 km W of its junction with Reserve Rd, 25 Aug. 2001, *J.W. Horn* 4008; Benn Reserve, 1 km NW of Kojonup, 14 Nov. 1999, *C.M. Lewis* 464; Serpentine National Park, about 750 m ESE of Chatfield Rd, 31 Oct. 1996, *A. Markey* 492; Red Hill, 22 Sep. 1944, *R. D. Royce s.n.* (PERTH 3107299); Helena Valley, 26 Sep. 1977, *J. Seabrook* 312; 2 miles [3.5 km] W of Eradu on Mullewa-Geraldton Rd, 1 Oct. 1966, *E.M. Scrymgeour* 1449; Helena Valley, Ridge Rd, 25 Sep. 1981, *J.R. Wheeler* 2013; Jarrahdale Scenic Drive, 2.5 km along Barge Rd from South West Hwy, 5 Oct. 1983, *J.R. Wheeler* 2231; 4.5 km N of Binnu, 6 Sep. 1984, *J.R. Wheeler* 2372; Eagle Bay, Meelup, 7 Sep. 1985, *J.R. Wheeler* 2402.

Phenology. Flowers between June and November, with a peak in September.

Distribution and habitat. Widely distributed from Binnu to Katanning, in the southern part of its range occurring in the far western Wheatbelt and along the Darling Range, with a disjunct population around Cape Naturaliste (Figure 7). A few collections from Jurien Bay and Green Head are close to the coast, but these are not usually on limestone. Mostly found in sandy soils over granite or laterite, in woodlands, mallee, shrublands and heath.

Conservation status. Widespread and common and not considered to be at risk.

Etymology. From the Latin *prolatus* (extended, elongated) in reference to the cincinnus having rather well-separated flowers compared with *H. spicata s.s.*, from which it has been segregated.

Notes. *Hibbertia prolata* is a widespread species. It tends to occur westwards of the range of the other widespread species, *H. polystachya*, but there is substantial overlap.

Most specimens of *H. prolata* have a distinctive sepal indumentum, comprising few to many spreading to retrorse, hooked hairs mostly concentrated towards the sepal base. The only other species in the group with a similar indumentum is *H. subglabra*, which differs in having the abaxial leaf lamina glabrous. The disjunct specimens from near Cape Naturaliste are typical in all other respects. A few specimens (e.g. *R.D. Royce s.n.* PERTH 3107299; *R.J. Hnatiuk* 790181) lack these hairs and appear superficially similar to *H. leptotheca* but can be distinguished from that species by the shorter, less slender anthers.

Seven specimens collected between Gillingarra, Jurien Bay and Arrino lack the hooked hairs and have a denser sepal indumentum of simple, ±appressed hairs. These are provisionally included in *H. prolata* pending further field work.

7. Hibbertia polystachya Benth, *Fl. Austral.* 1: 22–23 (1863). *Type citation*: 'W. Australia. Swan River, Drummond; Blackwood river, Oldfield.' (*syn*: [Oldfield] MEL 666681!; [Drummond] K 687446 image!, K 687447 image!, K 687448 image!, MEL 666680!).

Compact to straggling, often sprawling *shrubs* to 0.3(–0.7) m high, multi-stemmed at base and resprouting from the rootstock after fire; young stems sparsely to moderately stellate-pubescent, sometimes also with scattered simple hairs; older stems with grey, papery bark decorticating in strips. *Leaves* erect to spreading, scattered, narrowly elliptic to linear, 5–20 mm long, 0.8–3 mm wide, the margins revolute with the abaxial lamina usually exposed; adaxial lamina with sparse to abundant, short to long, soft, simple, often tubercle-based hairs, sometimes also with scattered, tubercle-based stellate hairs; abaxial lamina densely stellate-pubescent, the midrib with indumentum as for the adaxial lamina; apex obtuse to subacute. *Inflorescences* comprising (1–)2–5-flowered cincinni, the flowers well-separated; cincinna axis sparsely pubescent with usually long simple hairs, sometimes also with intermixed stellate hairs; bracts ±homomorphic, narrowly ovate to linear, 3–6 mm long, 1–2 mm wide, with indumentum as for the leaves. *Sepals* narrowly ovate to ovate, 7–10 mm long, abaxially pubescent to pilose with long, simple hairs sometimes intermixed with hooked and/or stellate hairs; midribs prominent; outer sepals often leaf-like with recurved margins, acute; inner sepals thinner, broader and less hairy than the outer, with broader (to obtuse) apex. *Petals* yellow, broadly obovate, 7.5–12 mm long, shallowly to deeply emarginate. *Stamens* (6–)10(11), all on one side of the gynoecium, shortly fused by their filaments; anthers oblong, 1.6–2 mm long, dehiscing by introrse, longitudinal slits. *Staminodes* 5–10, mostly lateral to and opposite the stamens (a few sometimes behind the stamens), those opposite sometimes broad and petaloid. *Carpels* 2; ovaries rather rectangular-cuboid, densely pubescent; styles excentric from near the carpel apex, ±straight then slightly curved at the apex, 1.2–1.8 mm long. *Ovules* 2 per carpel. *Fruiting carpels* and seeds not seen.

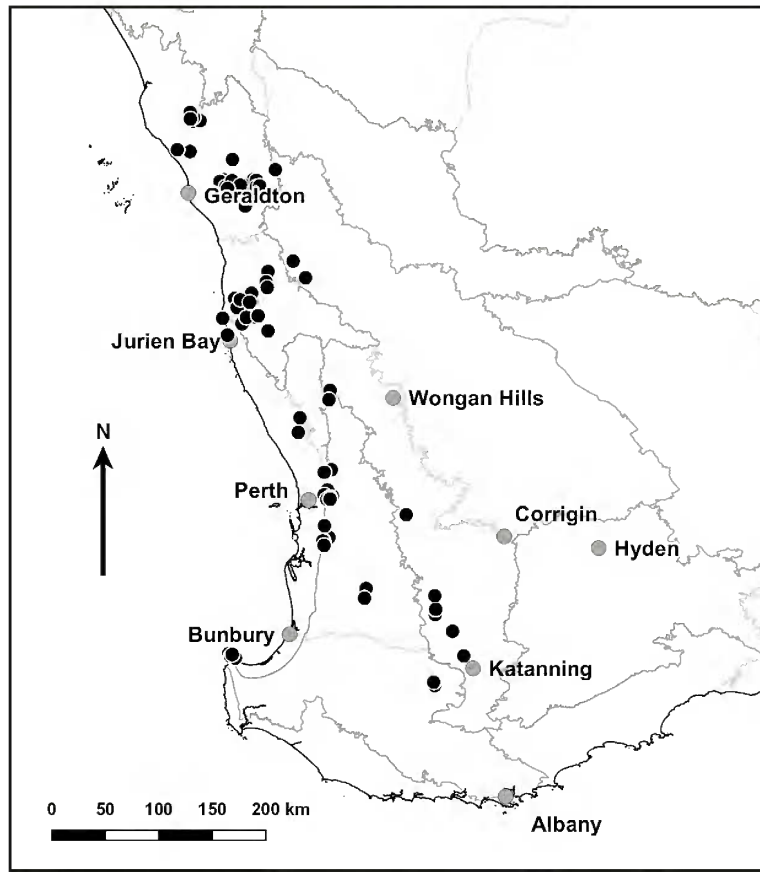

Figure 7. Distribution of *Hibbertia prolata*.

Diagnostic features. May be distinguished from all other species in the *Hibbertia spicata* species group by the adaxial leaf laminas and sepals with sparse to abundant simple hairs.

Selected specimens (all PERTH). WESTERN AUSTRALIA: 11.5 km S of Cachionalgo Hill, off Bindoon-Dewars Pool Rd, 7 Nov. 1996, *M.G. Allen* 303; 5 km NE of Cataby, 28 Oct. 1993, *P. Armstrong s.n.*; 8.5 km NW of Calingiri, 20 Sep. 1983, *R.J. Cranfield* 4339; Dobaderry Rd, 4.6 km N of Dale West Rd intersection, 8 Oct. 1997, *R. Davis* 4256; Bowelling-Duranillin Rd, 2.9 km from Bowelling, 17 Nov. 1997, *R. Davis* 4471; Jingaring Reserve, *c.* 33 km ESE of Brookton, 1 Sep. 1998, *R. Davis* 6526; Wambyn Nature Reserve, 9 Oct. 1998, *R. Davis* 7148; N end of Corry Rd, W of Corrigin, 24 Sep. 2007, *M. Hislop & H. Mills* WW 209-38; Along main road from Gingin to Dongara at crossing with Mullering Brook, 15 Sep. 1971, *R.D. Hoogland* 11969; Brand Hwy, 2.3 km S of its junction with Yandin Rd, 22 Aug. 2001, *J.W. Horn* 4000; Kondinin-Narembeen Rd, 220 m S of Billericay-East Rd, 24 Sep. 1997, *G.J. Keighery & N. Gibson* 3715; Narlingup Reserve, 28 km W of Kojonup, 17 Oct. 1997, *C.M. Lewis* 300; Stirling Rd, 25 km WNW of Kojonup, 5 Nov. 2000, *C.M. Lewis* 486; Airstrip Rd, 0.3 km from intersection of Jilakin Rd, 21 Oct. 2001, *S. Murray* 525; 73 km from Perth along main road to Brookton, by Christmas Tree Well, 27 Oct. 1982, *A. Strid* 21108; Chittering Valley Rd 35.8 km from Bullsbrook towards Bindoon, 5 Sep. 1982, *J.R. Wheeler* 2034; Dumbleyung-Lake Grace Rd, 17 km E of Dumbleyung, 21 Sep. 1986, *J.R. Wheeler* 2405; junction [of] Talbot West Rd and Talbot Rd, 9 Oct. 2001, *J.R. Wheeler* 4129; Beekeepers Reserve, 18 Sep. 1985, *R.T. Wills* 110.

Phenology. Flowers between August and December, with a peak in October.

Distribution and habitat. Widely distributed in the Western Australian wheatbelt and Darling Range from east of Mingenew to Katanning and west to near Kojonup, generally inland from the coast (Figure 8). Occurs on sandy, loamy and clay soils generally over granite or laterite, in wandoo woodlands, *Acacia* and *Allocasuarina* shrublands, mallee, and heathlands.

Conservation status. *Hibbertia polystachya* is widely distributed and common and is not considered to be at risk.

Notes. *Hibbertia polystachya* is more widespread and variable in leaf, cincinnus and sepal indumentum than any other species in the *H. spicata–H. polystachya* group. It tends to occur inland (east) of the other widespread taxon, *H. prolata*, although there is substantial overlap. Indumentum varies from sparsely pubescent with short, straight simple hairs arising from prominent tubercles to villous with long, soft, silky hairs without distinct tubercles. There may also be varying development of short stellate hairs interspersed with the simple ones. The variation, however, is continuous and, although there is a tendency for villous specimens to be at the western edge of the range, not geographically partitioned.

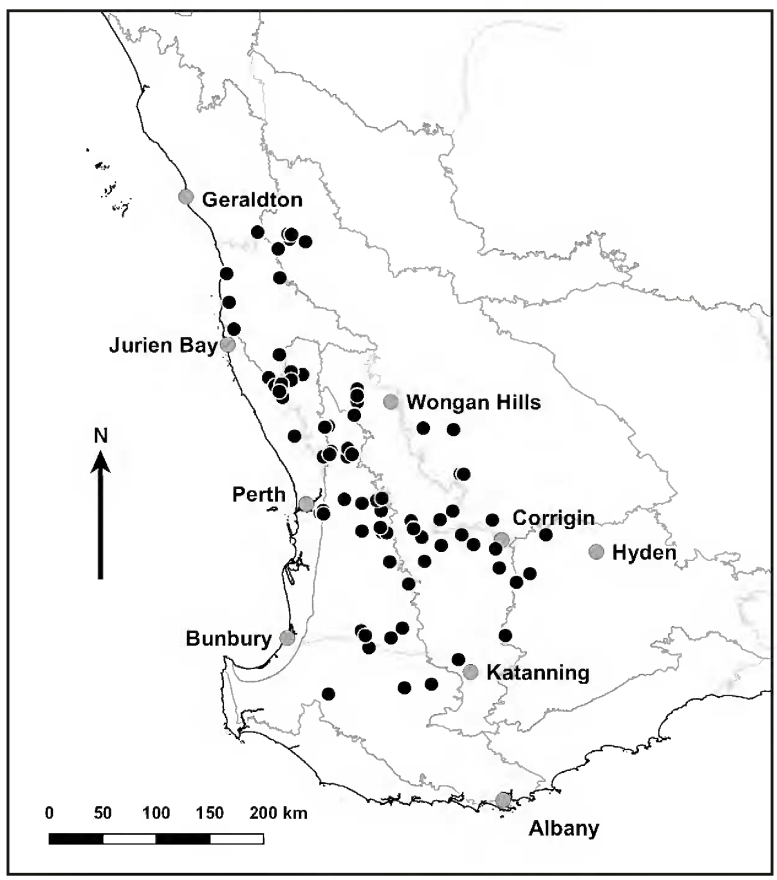

Figure 8. Distribution of *Hibbertia polystachya*.

In almost every case, specimens of *H. polystachya* may be distinguished from *H. prolata* by the presence of simple hairs on the adaxial leaf surface at least on young leaves. Leaves in *H. prolata* are adaxially glabrous.

One specimen (*J. Liddelow* 228) from near Lake Muir is unusual in having a glabrous abaxial leaf lamina (as for *H. subglabra*). However, it is typical for *H. polystachya* in all other respects, with simple-hairy adaxial leaf lamina and abaxial midrib, and typical sepal indumentum.

There are four Drummond specimens of *H. polystachya*, three at K and one at MEL, annotated variously as *Drummond* 15, *Drummond* 12, *Drummond* 17 and Drummond *s.n.*. All appear to be separate gatherings based on differences in leaf and sepal indumentum, and all fall within the range of variation of *H. polystachya* in these characters. Given that Bentham did not specify a Drummond number in the protologue for *H. polystachya*, all are here regarded as syntypes. I choose not to lectotypify as no benefit is to be gained by doing so at this time and I prefer to leave lectotypification as an option for future workers if the need arises.

Summary of taxon circumscriptions

Hibbertia polystachya Benth. in this paper has the same circumscription as *H. polystachya* Benth. as previously accepted at PERTH.

Hibbertia spicata F.Muell. in this paper has a narrower circumscription than *H. spicata* F.Muell. subsp. *spicata* as previously accepted at PERTH due to the removal of *H. asterella* K.R.Thiele, *H. subglabra* K.R.Thiele, *H. capensis* K.R.Thiele and *H. prolata* K.R.Thiele.

Hibbertia asterella K.R.Thiele *sp. nov.* in this paper is removed from *H. spicata* F. Muell. subsp. *spicata* as previously accepted at PERTH.

Hibbertia subglabra K.R.Thiele *sp. nov.* in this paper is a new taxon and is removed from *H. spicata* F. Muell. subsp. *spicata* as previously accepted at PERTH.

Hibbertia capensis K.R.Thiele *sp. nov.* in this paper is a new taxon and is removed from *H. spicata* F. Muell. subsp. *spicata* as previously accepted at PERTH.

Hibbertia prolata K.R.Thiele *nom. nov.* in this paper is removed from *H. spicata* F.Muell. subsp. *spicata* as previously accepted at PERTH.

Hibbertia leptotheca (J.R.Wheeler) K.R.Thiele *comb. et stat. nov.* in this paper has the same circumscription as *H. spicata* subsp. *leptotheca* as previously accepted at PERTH.

Acknowledgements

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